soaking an electrolyte into the assembly.

REMARKS

INTRODUCTION:

The disclosure was objected to due to a typographical error.

Claims 1-4 and 7 were rejected under 35 U.S.C.§ 102(b) as being anticipated by Koksbang (USPN 5,411,764).

Claims 1, 6 and 19 were rejected under 35 U.S.C. § 102(b) as being anticipated by Spillman et al. (USPN 6,410,181).

Claims 1, 7, and 13-18 were rejected under 35 U.S.C.§ 102(e) as anticipated by, or in the alternative, under 35 U.S.C.§ 103(a) as obvious over Nimon et al. (USPN 6,225,002).

Claims 1, 6, 7, and 12 were rejected under 35 U.S.C.§ 102(b) as anticipated by or, in the alternative, under 35 U.S.C.§ 103(a) as obvious over Skotheim et al. (USPN 5,961,672).

Claims 1, 6, and 19-20 were rejected under 35 U.S.C.§ 103(a) as being unpatentable over Spillman et al. (USPN 6,410,181) in view of Takeuchi et al. (JP 4-22069, abstract) or Hope et al. (USPN 4,888,206).

These rejections are respectfully traversed and reconsideration is requested.

Claims 5 and 8-11 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In accordance with the foregoing, the specification has been amended to improved form, claims claims 2, 3, 5, 6, 8-10, 12-14, 16-17 and 19 have been amended, and clalims 1, 4 and 7 have been cancelled without prejudice or disclaimer. No new matter is being presented, and approval and entry of the foregoing amendments and new claims are respectfully requested.

Claims 2-3, 5-6, and 8-20 are pending and under consideration. Reconsideration is requested.

CHANGES TO THE SPECIFICATION:

Paragraph 1 of the specification has been reviewed in response to this Office Action. The typographical error in paragraph 1 has been corrected to change "2001" to ---2000---. No

new matter has been added. The objection to paragraph 1 is now respectfully submitted to be moot.

REJECTION UNDER 35 U.S.C. §102:

In the Office Action at page 2, the Examiner rejected claims 1-4 and 7 under 35 U.S.C. §102(b) as being anticipated by Koksbang (USPN 5,411,764). This rejection is respectfully traversed and reconsideration is requested.

Koksbang teaches a battery having a positive electrode material (lines 56-57, col. 5), but fails to teach or suggest using a binder in the positive electrode, as is taught by the present invention. Claims 1, 4 and 7 have been cancelled. Dependent claims 2-3 each depend from amended claim 5, which is submitted to be in allowable form. The present invention teaches using a positive electrode comprising a positive active material and a binder. Thus, it is respectfully submitted that the rejection of claims 1-4 and 7 under Koksbang is now moot, and the present claimed invention is not anticipated by Koksbang under 35 U.S.C. §102(b).

In the Office Action at page 3, the Examiner rejected claims 1, 6 and 19 under 35 U.S.C. §102(b) as being anticipated by Spillman et al. (USPN 6,410,181). Claim 1 has been cancelled, claim 9 has been amended to depend from amended claim 10, which is in allowable form, and claim 19 has been amended to recite a positive electrode that includes a binder. This rejection is respectfully traversed and reconsideration is requested.

Spillman et al. teaches a thermally stable alkali metal anode in a battery, wherein the thermal stability is obtained by utilizing a lithium-alloy anode electrode (ll. 7-19, col. 3) and fails to teach or suggest using a positive electrode having a binder. Spillman et al. states: " a lithium-magnesium anode alloy containing 23% to 27%, by weight, magnesium offers the thermal stability required for operation of a primary lithium oxyhalide cell temperatures up to about 200° C while maximizing the cell's energy density. If the magnesium content is lower than approximately 23%, the resulting anode material lacks the thermal stability required for high rate discharge at 200° C" (ll. 11-17, col. 3). Thus, Spillman et al. teaches a lithium oxyhalide electrochemical cell in which the lithium metal electrode causes an internal short circuit as disclosed in col. 1, lines 44-45 of Spillman et al. However, in lithium-sulfur batteries, the lithium metal does not cause problems such as an internal short circuit. As a result, Spillman et al. teaches using a lithium-alloy electrode to solve the internal short circuit problem that may be

incurred when a lithium metal electrode is used in a lithium oxyhalide electrochemical cell. In contrast, the present claimed invention teaches improving the lithium metal electrode in a lithium battery.

Spillman et al. fails to teach or suggest using a positive electrode having a binder and suggests that an anode of lithium alone is thermally unstable, and thus undesirable. Hence, Spillman et al. teaches away from the present invention, which teaches using liquid lithium metal, i.e., not an alloy, to form the negative electrode and using a positive electrode having a binder. Thus, it is respectfully submitted that Spillman et al. does not anticipate claims 6 and 19 under 35 U.S.C. §102(b).

REJECTION UNDER 35 U.S.C. §102, §103:

Claims 1, 7, and 13-18 were rejected under 35 U.S.C.§ 102(e) as anticipated by, or in the alternative, under 35 U.S.C.§ 103(a) as obvious over Nimon et al. (USPN 6,225,002). This rejection is respectfully traversed and reconsideration is requested.

Claims 1 and 7 have been cancelled. Rejection of claims 1 and 7 is deemed moot in view of their cancellation.

Claims 5 and 10 were rewritten in independent form to include the limitations of their base claims, respectively, and are now in allowable form (see page 8 of the Office Action). Claims 13-14 and 16-17 have been amended to depend from amended claims 5 and 10. Claims 15 and 18 depend from claims 13 and 17, respectively. Thus, dependent claims 13-18 are allowable for at least the reasons that amended claims 5 and 10 are allowable. Hence, it is respectfully submitted that Nimon et al. does not anticipate claims 13-18 under 35 U.S.C.§ 102(e).

Nimon et al. teaches an electrode that includes only a lithium metal, whereas the present claimed invention teaches an electrode having a lithium metal and a current collector. The use of a current collector provides a higher capacity and an improved capacity retention, as is shown in Table 1 at page 7 of the specification. Table 1, reproduced below for the Examiner's convenience, shows the capacity and remaining capacity of the cell of the negative electrode with a current collector (Example 1) and without a current collector (Comparative Example 2).

Table 1

		Cycles		
		1st	50th	100th
Comparative example 1	Capacity (mAh/g)	550	467	303
	Remaining capacity (%)	100	85	55
Comparative example 2	Capacity (mAh/g)	559	486	336
	Remaining capacity (%)	100	87	60
Example 1	Capacity (mAh/g)	560	504	392
	Remaining capacity (%)	100	90	70

Thus, the present claimed invention has the unexpected effect of providing a higher capacity and an improved capacity retention, and is not obvious in view of Nimon et al.

In addition, Nimon et al. teaches a positive electrode that includes an electrochemically active material and an electrolyte (ll. 32-35, col. 3), but fails to teach or suggest utilizing a binder in the positive electrode. Amended claims 5 and 10 include a binder in the positive electrode.

Since Nimon et al. fails to teach using a binder in the positive electrode, and the courts have held that the Examiner may not suggest modifying the references using the present invention as a template absent a suggestion of the desirability of the modification in the prior art *In re Fritch,* 23 U.S.P.Q. 2d 1780 (Fed. Cir. 1992), and since nothing in the prior art suggests combining a binder with the positive electrode and using a lithium negative electrode together in the battery, it is respectfully submitted that claims 13-18 are allowable under 35 U.S.C.§ 103(a). In addition, as recited above, claims 13-18 depend from amended claims 5 and 10, which are deemed to be allowable. Hence, claims 13-18 are allowable for at least the reasons that claims 5 and 10 are allowable.

Claims 1, 6, 7, and 12 were rejected under 35 U.S.C.§ 102(b) as anticipated by or, in the alternative, under 35 U.S.C.§ 103(a) as obvious over Skotheim et al. (USPN 5,961,672). This rejection is respectfully traversed and reconsideration is requested.

Claims 1 and 7 have been cancelled. Claim 6 has been amended to depend from amended claim 5, which is in allowable form. Claim 12 has been amended to depend from amended claim 10, which is in allowable form.

Skotheim et al. teaches using a lithium metal anode having a thin film of lithium metal-ion conducting polymer which is doped n-type by the incorporation of lithium ions and is deposited on the lithium anode surface by vacuum evaporation (ll. 37-47, col. 2) to stabilize the anode. In contrast, the present invention teaches a lithium negative electrode having lithium melted onto a metal current conductor such as nickel, copper, or a metal-sprayed nickel or copper under an inert gas to prevent formation of oxides. These are different anode electrodes that behave differently. Skotheim et al. submits that their coated lithium anode is superior chemically in that it does not develop dendrites, i.e., pitting, upon repeated plating of lithium metal during charging of the battery (line 60 of col. 5 through line 6 of col. 6), and thus has a longer battery life and fewer safety hazards than a battery having an unprotected lithium anode, as in the present invention. Thus, it is respectfully submitted that Skotheim et al. teaches away from the present Invention and does not anticipate the present invention under 35 U.S.C.§ 102(b). In addition, Skotheim et al. fails to teach or suggest the lithium coated metal current conductor of the present invention. The courts have held that the Examiner may not suggest modifying the reference using the present invention as a template. *In re Fritch,* 23 U.S.P.Q. 2d 1780 (Fed. Cir. 1992). Hence, it is respectfully submitted that the present invention is non-obvious, and claims 6 and 12 are allowable under 35 U.S.C.§ 103(a) over Skotheim et al.

Claims 1, 6, and 19-20 were rejected under 35 U.S.C.§ 103(a) as being unpatentable over Spillman et al. (USPN 6,410,181) in view of Takeuchi et al. (JP 4-22069, abstract) or Hope et al. (USPN 4,888,206). This rejection is respectfully traversed and reconsideration is requested.

Claim 1 has been cancelled. Claim 6 has been amended to depend from amended claim 5, which is in allowable form. Claim 19 has been amended to recite a positive electrode that includes a binder. Claim 20 depends from amended claim 19.

It is respectfully submitted that the Examiner is piecing together Spillman et al., Takeuchi et al., or Hope et al. to support his position that the present invention is obvious in view of Spillman et al., Takeuchi et al., or Hope et al. Since nothing in the references suggests a basis for the Examiner's assertion that said references should be combined, and the courts have held that the references must suggest such a combination in order to show obviousness (*In re Wright*, 848 F.2d 1216, 6 U.S.P.Q. 2d 1959 (Fed. Cir. 1988)), it is respectfully submitted that the present invention is non-obvious, and claims 6 and 19-20 are allowable under 35 U.S.C.§ 103(a) over Spillman et al. (USPN 6,410,181) in view of Takeuchi et al. (JP 4-22069, abstract) or Hope et al. (USPN 4,888,206).

CLAIMS OBJECTED TO

Claims 5 and 8-11 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 5 and 10 have been amended to include all the limitations of independent claims 1 and 7, respectively. Claims 8-9 were amended to depend from amended claim 10. Claim 11 depends from amended claim 10. Thus, amended claims 5 and 8-10 are submitted to be in allowable form.

ATTACHMENT

Attached hereto is a "Version With Markings to Show Changes Made," comprising a marked-up version of changes made to the Specification and Claims by the current amendment.

CONCLUSION:

In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot. And further, it is respectfully submitted that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited by the Examiner contacting the undersigned attorney for a telephone interview to discuss resolution of such issues.

If there are any additional fees associated with the filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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VERSION WITH MARKING TO SHOW CHANGES MADE

IN THE SPECIFICATION

Please AMEND paragraph [0001] on page 1 to read as follows:

[0001] This application is based on Korean Application No. 2000-32515 filed in the Korean Industrial Property Office on June 13, 2000, the content of which is incorporated hereinto by reference.

IN THE CLAIMS

Please **AMEND** claims 2, 3, 5, 6, 8-10, 12-14, 16-17 and 19 and **CANCEL** claims 1, 4, and 7 without prejudice or disclaimer as follows. The remaining claims are reprinted, as a convenience to the Examiner, as they presently stand before the U.S. Patent and Trademark Office.

1. Cancelled.

2. (ONCE AMENDED) The lithium battery according to claim [1] 5, wherein the liquid lithium metal is coated using a doctor blade.

3. (ONCE AMENDED) The lithium battery according to claim [1] 5, wherein the liquid lithium metal is coated using a calendering process.

4. Canceled.

5. (ONCE AMENDED)) A lithium battery comprising:

a lithium negative electrode prepared by melting lithium metal under an inert gas atmosphere and coating the liquid lithium metal on a metal current collector;

a positive electrode including a binder;

a separator placed between the positive and negative electrodes; and

an electrolyte comprising a lithium salt and organic solvents, contained in the positive and negative electrodes and the separator,

wherein the current collector is nickel, copper or a metal-sprayed nickel or copper, and

the metal being sprayed is a lithium-wetting metal,

[The lithium battery according to claim 4,] wherein the lithium-wetting metal is selected from the group consisting of Al, Si, and Sn.

6. (ONCE AMENDED) The lithium battery according to claim [1] 5, wherein [said positive electrode further comprises a] the binder is selected from the group consisting of polyvinylidene fluoride, polytetrafluoroethylene, polyvinyl acetate, polyethylene oxide, polypyrrolidone, and polyvinyl alcohol.

7. Cancelled.

8. (ONCE AMENDED) The lithium-sulfur battery according to claim [7] 10, wherein the liquid lithium metal is coated using a doctor blade.

9. (ONCE AMENDED) The lithium-sulfur battery according to claim [7] 10, wherein the liquid lithium metal is coated using a calendering process.

10. (ONCE AMENDED) A lithium-sulfur battery comprising:

a lithium negative electrode prepared by melting lithium metal under an inert gas atmosphere and coating the liquid lithium metal on a metal current collector;

a positive electrode comprising a positive active material, an electrically conductive material and a binder, the positive active material comprising at least one sulfur-based material selected from the group consisting of elemental sulfur and solid Li_2S_n ($n \geq 1$) coated on a current collector;

a separator placed between the positive and negative electrodes; and

an electrolyte comprising a lithium salt and organic solvents, contained in the positive and negative electrodes and the separator,

[The lithium-sulfur battery according to claim 7,] wherein the current collector is nickel, copper or a metal-sprayed nickel or copper, and the metal being sprayed is lithium-wetting metal.

11. (UNAMENDED) The lithium-sulfur battery according to claim 10, wherein the lithium wetting metal is selected from the group consisting of Al, Si, and Sn.

12. (ONCE AMENDED) The lithium-sulfur battery according to claim [7] 10, wherein the binder is selected from the group consisting of polyvinylidene fluoride, polytetrafluoroethylene, polyvinyl acetate, polyethylene oxide, polypyrrolidone, and, polyvinyl alcohol.

13. (ONCE AMENDED) The lithium battery according to claim [1] 5, wherein the lithium battery retains 90% or greater of a capacity at the fiftieth charging and discharging cycle as compared to the capacity at the first charging and discharging cycle.

14. (ONCE AMENDED) The lithium battery according to claim [1] 5, wherein the lithium battery retains 70% or greater of a capacity at the one hundredth charging and discharging cycle as compared to the capacity at the first charging and discharging cycle.

15. (UNAMENDED) The lithium battery according to claim 13, wherein the lithium battery retains 70% or greater of the capacity at the one hundredth charging and discharging cycle as compared to the capacity at the first charging and discharging cycle.

16. (ONCE AMENDED) The lithium battery according to claim [7] 10, wherein the lithium battery retains 90% or greater of a capacity at the fiftieth charging and discharging cycle as compared to the capacity at the first charging and discharging cycle.

17. (ONCE AMENDED) The lithium battery according to claim [7] 10, wherein the lithium battery retains 70% or greater of a capacity at the one hundredth charging and discharging cycle as compared to the capacity at the first charging and discharging cycle.

18. (UNAMENDED) The lithium battery according to claim 17, wherein the lithium battery retains 70% or greater of the capacity at the one hundredth charging and discharging cycle as compared to the capacity at the first charging and discharging cycle.

19. (ONCE AMENDED) A method of manufacturing a lithium battery, comprising:

coating a liquid lithium metal on a current collector to create a negative electrode;

obtaining a positive electrode that includes a binder;

placing a separator between the positive and negative electrodes to produce an assembly; and

soaking an electrolyte into the assembly.

20. (UNAMENDED) The method according to claim 19, further comprising melting a lithium metal under a gas atmosphere to produce the liquid lithium metal.